TUKTOYAKTUK PENINSULA

Resource Analysis Report of Ibyuk Hill Pingo Area

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Prepared by Y.R. Alkema & T.J. Kovacs

Co-ordinator - Planning Studies Parks System Planning Division
National Parks Branch
July, 1977

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of Ibyuk Hill Pingo Area

Indian and Northern Affairs. Parks Canada

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Table of Contents

Objective of Study 1
Conclusion 1
Recommendations 1

Introduction 3

Delimitation of Area of Interest 7

Pingo Evolution 8
Ibyuk Hill 12

The Regional Setting- Natural History of the Tuktoyaktuk Peninsula 14
  Physical Features 14
  Biological Features 15

Land Use 17
  Use by the Inuit 17
  Reindeer Grazing Reserve 17

Natural Resource Exploration 18

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and

T.J. Kovacs

Co-ordinator - Planning Studies

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Table of Contents

Objective of Study 1
Conclusion 1
Recommendations 1

Introduction 3

Delimitation of Area of Interest 7

Pingo Evolution 8
Ibyuk Hill 12

The Regional Setting: Natural History of the Tuktoyaktuk Peninsula 14
  Physical Features 14
  Biological Features 15

Land Use 17
  Use by the Inuit 17
  Reindeer Grazing Reserve 17

Natural Resource Exploration 19

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Objective of Study

To conduct a preliminary resource analysis within a Natural Area of Canadian Significance to the south of Tuktoyaktuk in the Northwest Territories, in order to assess its potential as a National Landmark.

Conclusion

The criteria set forth in the National Landmark Policy state that a potential Landmark area must contain "a natural feature or phenomenon which is unique or rare in Canada or the world; alternatively, the site may be the best example of a particular natural theme component in Canada". The area of interest contains fine examples of the pingo phenomenon, which meet and exceed the above criteria in terms of both its unique geologic and scenic attributes.

Recommendations

1. That the 12.8 km^2 Area of Interest be accepted as qualifying for National Landmark status.

2. That the following be undertaken:
    a) A study of the social and economic impact of a National Landmark in this area on the way of life of the local people;

b) Further discussions with the Territorial Government, the Native Groups, the Northern Program and the general public in order to assess the feasibility of establishing a National Landmark at this time to protect the area.

Introduction

"There are many small but unique wonders of nature in our country which need to be protected such as the Chubb Crater in northern Quebec, the frozen pingos of the Arctic, semi-desert and eroded hills of the Prairies, caves in our mountains and seascapes.

These National Landmarks might be considered as miniature National Parks, designated primarily to protect specific natural phenomena without requiring large land holdings in order to preserve and interpret. Not only would they serve as indicators of Canada's unique natural heritage but would allow for excellent on-site interpretive possibilities of our country's natural evolution." (Byways and Special Places booklet, 1972).

National Landmarks are defined as being relatively small land or water sites that are: in need of a high degree of protection; unique, rare or one-of-a-kind in Canada; single-feature, phenomenon or theme oriented; fragile; of important scientific value; significant at the national level; conducive to study, research or appreciation but not outdoor recreation activities; and finally, able to withstand very little development.

Parks Canada has, for some time, been interested in creating a Pingo National Landmark. Pingos are ideally suited for such a designation. Parks Canada has received several suggestions, one as early as 1965, to examine the potential of these peculiar features, but it was not until the summer of 1970 that the National Parks Branch undertook a preliminary field survey of these features. Parks Canada's involvement was greatly hastened by the announcement of expanding oil and gas exploration activities which were to commence in the Tuktoyaktuk Peninsula at about that time.

As a result of the 1970 survey, two areas were delineated for further study. The first, an area of approximately 330 km^2 along the coast northeast of Tuktoyaktuk, and the second, a 13 km^2 area, to the southwest of the hamlet. These areas were found to contain the highest concentration of pingos in the entire region. The region was visited twice during 1971 to observe the exploration work carried out by Imperial Oil Enterprises (I.O.E.) and to assess its effects on the environment. Another field trip was carried out in the area in 1972, to collect further field data and to examine the National Park potential of a much larger area that included the whole of Tuktoyaktuk Peninsula, the Eskimo Lakes, and the coastal area west of of Tuktoyaktuk as far as Garry Island.

The 1972 field examination revealed considerable National Park potential in this larger area. It is important in terms of large terrestrial and marine mammal populations and habitats, and also possesses significant waterfowl nesting, migratory, and moulting sites and contains outstanding representations of tundra vegetation. However, from the point of view of Parks Canada, the most important feature of the Tuktoyaktuk Peninsula are the pingos, and the decision was made to seek a National Landmark that would be oriented to the unique pingo phenomenon, as opposed to a larger representative landscape suitable for National Park purposes.

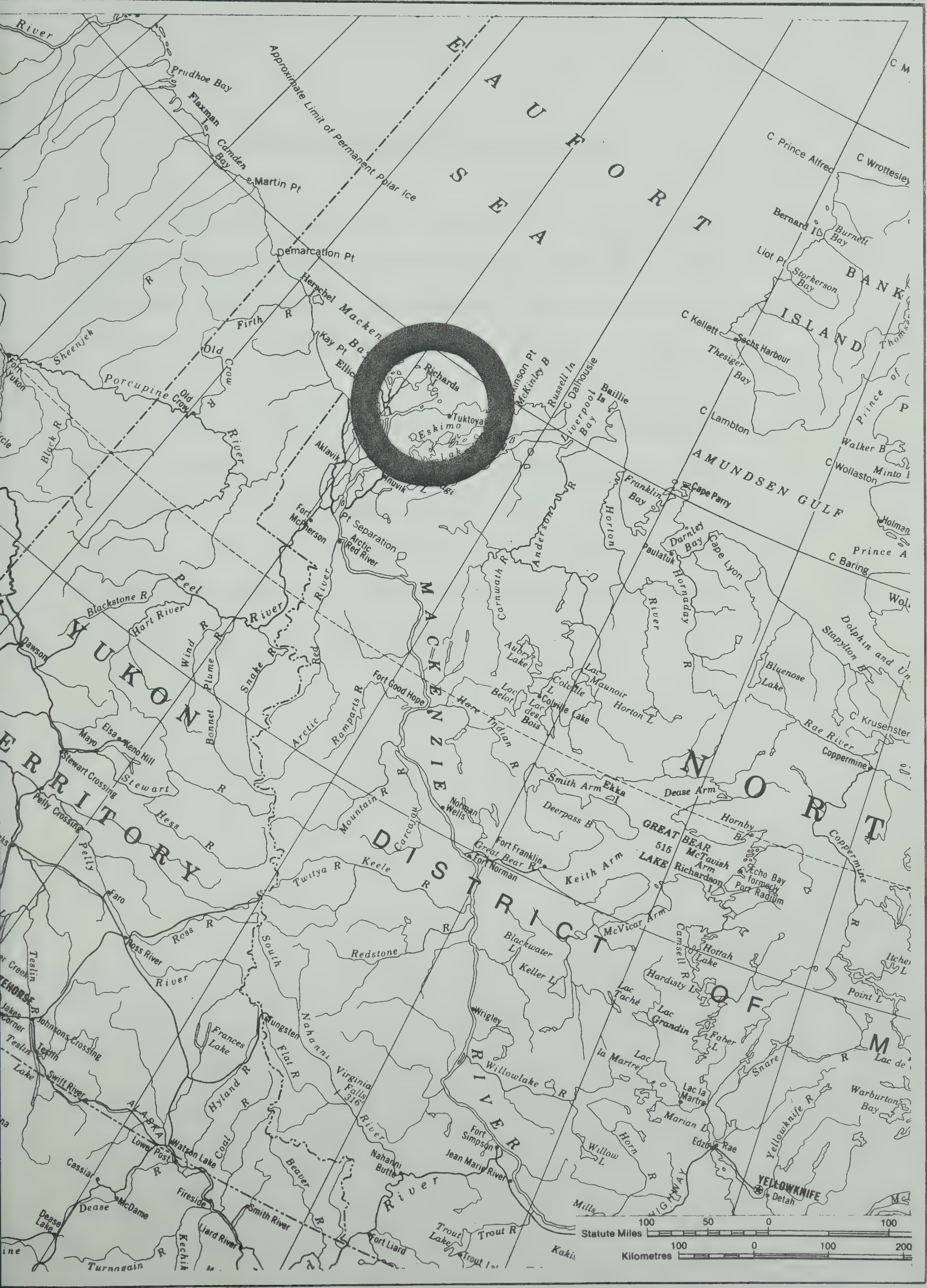
Communication between I.O.E. and the Department of Indian Affairs and Northern Development led to the surrender of the Company's oil and gas interests in a specific area of concern to Parks Canada - an area surrounding the Ibyuk Hill pingo.

A Pingo National Landmark would be the first National Landmark in Canada, and its creation can be viewed as desirable from many perspectives.

For Canada and the Northwest Territories the National Landmark designation would offer national and international recognition of one of its natural wonders which, as a result, is bound to become a focal point of public interest.

For the people of Tuktoyaktuk, it would present some direct or indirect employment opportunities, as facilities are provided and visitors are attracted to the area in increasing numbers.

The National Landmark would stand as a model of co-operation and coexistence between conservation and resource interests. The positive attributes in this proposal, for all concerned, are considerable and it deserves enthusiastic support.


BEAUFORT SEA
Approximate Limit of Permanent Polar Ice
Prudhoe Bay
Flaxman I
Camden Bay
Martin Pt
Demarcation Pt
Herschel
Mackenzie Bay
Kay Pt
Richards
Tuktoyaktuk
Eskimo Lakes
Aklavik
Inuvik
McKinley B
Russell In
C Dalhousie
Baillie Is
Liverpool Bay
Fort McPherson
Pt Separation
Arctic Red River
Firth R
Old Crow
Crow R
Porcupine
Sheenjek
Fort Yukon
Black R
River
Blackstone R
Peel River
Hart River
Wind R
Plume R
Bonnet Plume
Snake R
Arctic Red River
Ramparts R
Dawson
YUKON TERRITORY
Mayo
Elsa
Keno Hill
Stewart Crossing
Stewart R
Pelly Crossing
Pelly
Hess R
Faro
Ross River
Ross R
Teslin
Whitehorse
Jakes Corner
Johnsons Crossing
Teslin Lake
Swift River
ALASKA HIGHWAY
Watson Lake
Lower Post
Cassiar
McDame
Dease
Dease Lake
Turnagain
Kechika R
Liard River
Fireside
Smith River
Frances Lake
Hyland R
Coal R
Tungsten
Flat R
South Nahanni River
Virginia Falls 316
Nahanni Butte
Beaver R
Fort Liard
Fort Simpson
Jean Marie River
Trout Lake
Trout R
Kakisa
Mills L
MACKENZIE RIVER
MACKENZIE DISTRICT
Fort Good Hope
Hare Indian R
Mountain R
Carcajou R
Norman Wells
Fort Franklin
Great Bear R
Fort Norman
Twitya R
Keele R
Redstone
Blackwater L
Keller L
Wrigley
Willowlake R
Willow L
Horn R
HIGHWAY
Carnwath R
Anderson R
Horton R
Aubry Lake
Colville L
Colville Lake
Lac Maunoir
Lac Belot
Lac des Bois
Horton L
Smith Arm
Ekka I
Deerpass B
Dease Arm
GREAT BEAR LAKE 515
McTavish Arm
Keith Arm
Richardson I
Echo Bay formerly Port Radium
Hornby B
McVicar Arm
Camsell R
Hottah Lake
Hardisty L
Lac Taché
Lac Grandin
Faber L
Lac la Martre
Lac la Martre
Marian L
Edzo
Rae
Snare R
Yellowknife R
YELLOWKNIFE
Detah
Warburton Bay
Lac de
Point L
Itchen L
NORTHWEST TERRITORIES
Franklin Bay
Cape Parry
Darnley Bay
Paulatuk
Cape Lyon
Hornaday River
AMUNDSEN GULF
C Lambton
C Kellett
Sachs Harbour
Thesiger Bay
BANKS ISLAND
C Prince Alfred
C Wrottesley
Bernard I
Burnett Bay
Liot Pt
Storkerson Bay
Thomsen
Prince of Wales
Walker B
Minto I
C Wollaston
Holman
Prince Albert
C Baring
Dolphin and Union
Stapylton B
Bluenose Lake
C Krusenstern
Rae River
Coppermine
Coppermine R
Statute Miles 100 50 0 100
Kilometres 100 0 100 200

Delimitation Of Area Of Interest

The proposed Pingo National Landmark is located six km south-southwest of the village of Tuktoyaktuk in the Northwest Territories. Tuktoyaktuk is situated 110 km north of Inuvik, and 2200 km northwest of Edmonton, Alberta.

The proposed boundaries encompass the largest example of a pingo in Canada, and would include related permafrost features in varying stages of evolution. The Area of Interest, 12.8 km^2, is delimited on the north and west by a water/land boundary along the shore of Kugmallit Bay. More than 44% of the area is water.

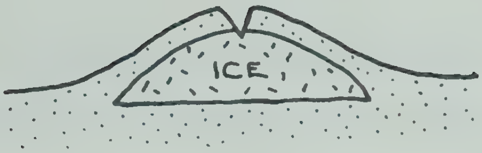
Pingo Evolution

The landscape around Tuktoyaktuk, east of the present delta , consists of the old, Pleistocene delta of the Mackenzie River, and is one of the strangest and most striking in Canada. From the rolling, lake-littered tundra, underlain by some 90 m of permafrost, project hundreds of low, abrupt hills. They are known as pingos from the Eskimo word pingujjaluit (the things which thrust upwards). Some are dome shaped, some are only mere swellings, while others bear a striking resemblance to small volcanoes, complete with small crater, and in some cases a crater lake.

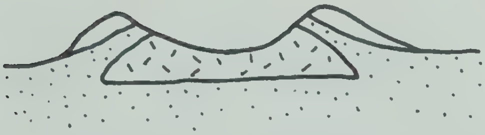
Among the descriptive criteria commonly employed to define a pingo are: (1) location in area of continuous permafrost; (2) hill-form, typically with a conical cross section and circular or oval base; (3) interior core of massive ice; (4) existence for longer than a single season (i.e., "perennial"); and (5) comparatively large size with respect to other varieties of frost mounds.

It is generally considered that there are two major varieties of pingos, those formed from cryostatic (ice) pressure and those formed by hydrostatic pressure. Cryostatically generated pingos result from the encroachment of a freezing front on sub-permafrost saturated ground.

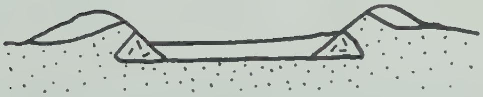
Ibyuk Hill.



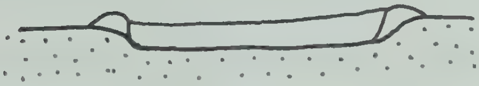
Breaching of the ice core



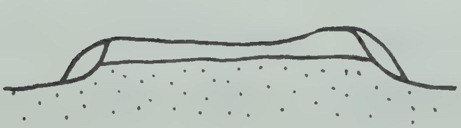
Progressive melting of the ice core



Progressive melting of the ice core



Pingo Scar - ice completely melted



Depression filling with sediment

Formation of a pingo scar

Cryostatic pressure causes the confined water to be ejected upward where it freezes to form a pingo core. These are "Mackenzie type" pingos and are regarded as closed systems. The mean annual air temperature required for a closed system pingo to form is -6°C or lower.

The second type of pingo is the "Greenland" or open system pingo. This type is created by hydrostatic (artesian) pressure in areas of discontinuous permafrost. The mean annual air temperature required for an open system pingo to form is from -1° to -6°C.

The presence of extensive massive ice and icy sediments in permafrost areas indicates a fragile character. Any natural or man-made disturbance of the thermal regime, which causes permafrost degradation and an increase in the active layer, will melt massive ice or icy sediment. Thermal erosion is difficult to control once icy material becomes exposed.

Pingos degenerate as a result of breaching of the ice core, most often at the summit, either by exposure in tension fractures or erosion of overburden. Exposure of the ice core allows seasonal melting and sublimation of the core. With progressively greater melting of the core, relief is gradually lowered until eventually relief is inverted and

the original mound has become a depression. At this stage the pingo has become a pingo scar.

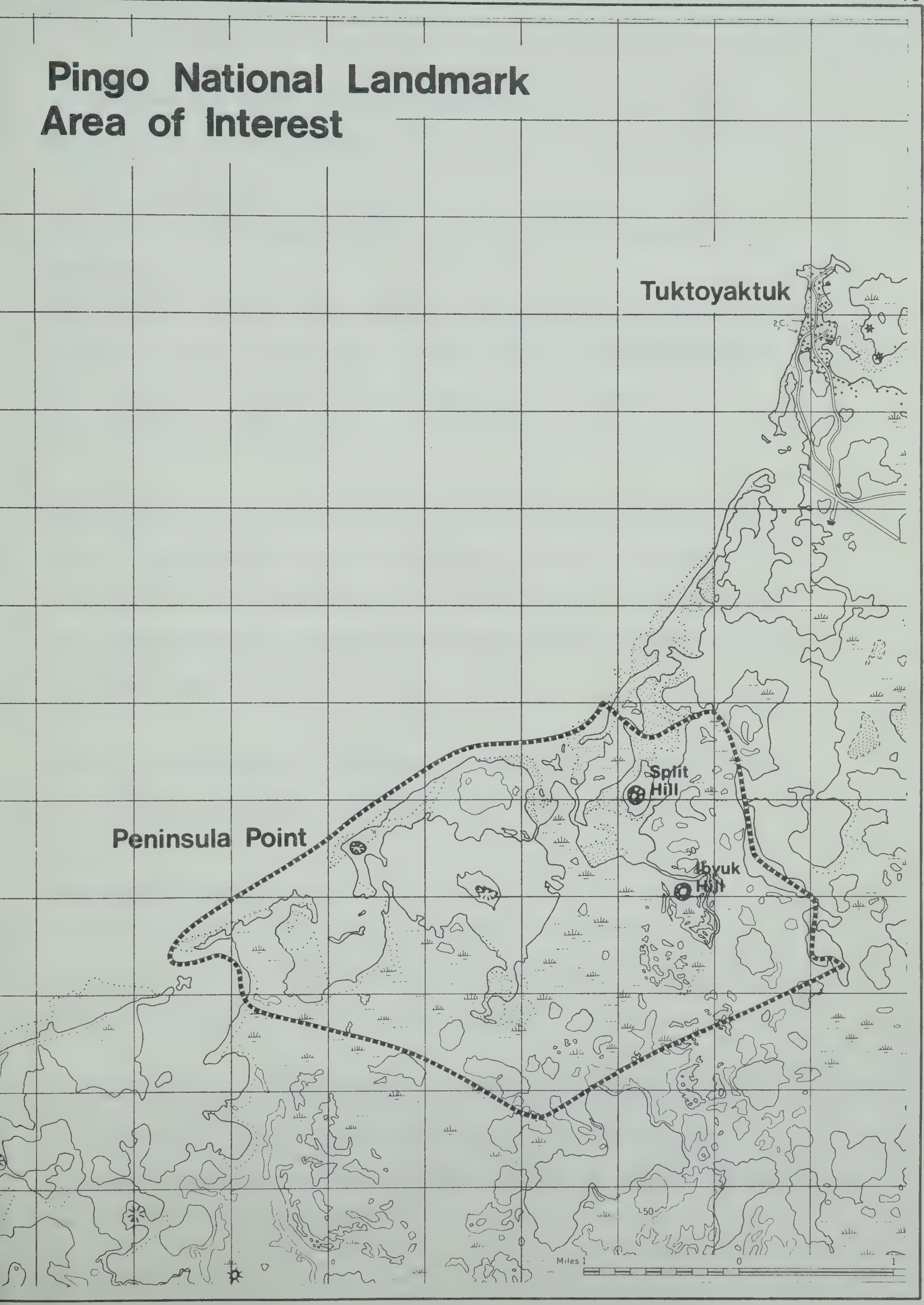
The pingos of the Tuktoyaktuk area almost invariably occur in depressions which represent former lake basins. Some pingos protrude as islands surrounded by moat-like shallow lakes. It has been estimated that 56% of pingos are wholly or partly surrounded by water, while the remainder are surrounded by poorly drained tundra, often with tundra polygons.

Ibyuk Hill

While it is larger than many, the Ibyuk Hill pingo, located within the proposed Landmark area, is typical in many respects. It is 900 m in circumference at the base, and, rising 40 metres above the surrounding marshy land, is a prominent landmark. In the summit there is a well-developed crater-like hollow, and the sides of the pingo are deeply fissured. In the crater there is a small lake, which in summer measures five metres by eight metres in area, and about one metre deep. The surface of the pingo is entirely covered with sand, silt and clay.

Like many pingos, Ibyuk Hill is asymmetric in cross-section, and appears symmetrical only when viewed from one side. The steepest slopes on this, or any pingo, rarely exceed 45°, and are much gentler on small incipient pingos.

Pingo National Landmark Area of Interest


Tuktoyaktuk
R.C.
Split Hill
Peninsula Point
Ibyuk Hill
50
50
Miles 1
0
1

In the case of Ibyuk Hill the massive core of ice lies beneath 14 m of overburden.

The Regional Setting: Natural History of the Tuktoyaktuk Peninsula

Most of the coastal area consists of Pleistocene fluvial and deltaic deposits, generally lying below an altitude of 60 m. The Pleistocene epoch is indicated by the dispersed distribution of mammoth tusks, teeth and bison horns.

During the last glacial ice advance, the Wisconsonian, the entire area was glaciated as indicated by the frequent occurrence of ground moraines, end moraines, eskers, outwash and kame deposits, sediments deformed by ice-thrust, glacial drainage channels and proglacial lakes.

There is evidence of a sequence of post glacial submergence, emergence and another submergence of the study area.

Physical Features

Prevailing winds have built parabolic, cliff-head and crescentic dunes. The latter are typically 250 to 500 m long, 10m to 30 m wide and several metres high.

Tundra polygons, distributed widely in the region, are the most prominent type of patterned ground. They are particularly numerous in former lake bottoms and range from six metres to 30 m in diameter.

Massive, tabular, horizontal sheet ground-ice, a physical feature commonly found in this area of continuous permafrost, underlies many tens of square kilometres of the Pleistocene sediments.

Coastal recession is rapid, aided by the presence of easily eroded sands, horizontal ice-sheets and violent westerly storms. The average rate of coastal recession in one 50 year period was from 0.3 to 0.6 m per year.

Storm breakers, 1 m to 1.5 m above sea level, are indicated by the widespread distribution of driftwood which are lodged as far as 3.2 km inland on low coasts.

Biological Features

The flora and fauna of the Tuktoyaktuk Peninsula are typical of the tundra. Lying north of the Boreal Forest, the surrounding region is covered by transitional and tundra communities. In general, wet tundra with many sedgy tussocks are found on poorly drained flats, dry tundra including lichen and moss heath on better drained areas, and thickets of willow, alder and ground birch in valleys and on slopes.

The surrounding Tuktoyaktuk Peninsula contains a variety of wildlife, particularly large terrestrial and marine mammals and birds. It provides habitat to such large mammals as the

barren-ground grizzly bear, polar bear, grey wolf, barren-ground caribou and musk-ox. Pingos are important habitat for arctic fox, which den on the hills, usually the driest land for miles around. Marine mammals frequenting the coast are the bowhead whale, Pacific killer whale, white whale, and seals. More than 65 bird species, including swans, geese, ducks, eagles, falcons, hawks, owls and cranes have been observed in the area.

Land Use

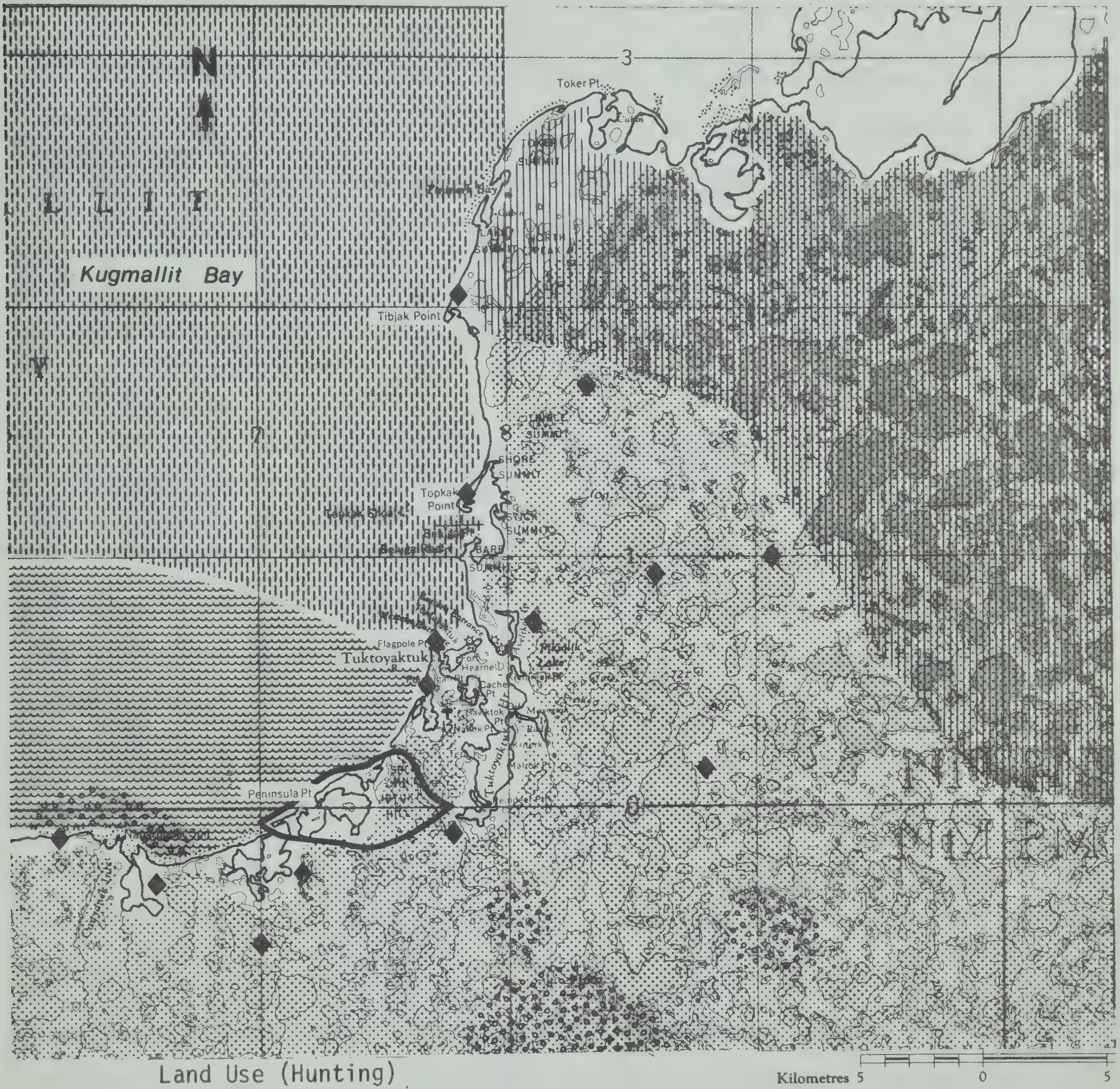
Use by the Inuit

Except for the settlement of Tuktoyaktuk, the surrounding countryside of the Peninsula is not inhabited. Although largely sedentary, the Inuit population is still the most land-tied occupant of the north, having a dependence on the land, at least in part, for livelihood.

The Area of Interest lies within a larger region that is used by Tuktoyaktuk hunters, trappers and fishermen at various times during the year. In the vicinity of the Area of Interest, activities include whaling, fishing, muskrat and wildfowl hunting. The use is seasonal and not intensive, but nevertheless important to the Inuit. As traditional rights have been maintained in the most recently established National Parks, the application of the same policy is envisaged in the case of a National Landmark near Tuktoyaktuk.

Reindeer Grazing Reserve

A Reindeer Grazing Reserve covers the entire Tuktoyaktuk Peninsula, part of the Mackenzie Delta and the Eskimo Lakes district west of Anderson River. Consisting of 46000 km^2 this Reserve was established in 1935 when 2370 reindeer were brought to the area to create a self-sustained Inuit industry.


N
Kugmallit Bay
Toker Pt.
Tibjak Point
Topkak Point
Flagpole Pt
Tuktoyaktuk
Hearne
Cache Pt
Peninsula Pt
Kilometres 5 0 5

Land Use (Hunting)

Legend

≋ Whale

▥ Polar Bear / Seal

▥ Wolf

░ Muskrat

⁘ Fishing

◆ Wildfowl

— Area of Interest

The experiment has not been successful for many complex reasons and the Canadian Wildlife Service (C.W.S.) assumed responsibility for operations in 1968. After several years of management, the C.W.S. has terminated its involvement in the venture, and the 5500 to 6000 animal herd has been sold to native herders in Tuktoyaktuk.

Natural Resource Exploration

The Tuktoyaktuk Peninsula is a structural and topographic high extending northeast of the main channel of the Mackenzie River for about 240 km. The high is formed by large faults which step down northwest to the Beaufort Sea with throws of up to 900 m. Much of the displacement was pre-Mesozoic as indicated by the great age differences in the rocks subjacent to the pre-Mesozoic surface. The Mesozoic and Tertiary section thickens to the northwest to over 9000 m in the Mackenzie Delta - Beaufort Sea. There are three known oil and gas pays on the Peninsula; 1) Middle Devonian reefal carbonates tested oil and gas at Mayogiak field; 2) Lower Cretaceous beach sands and braided stream deposits tested oil at Atkinson field; and 3) Tertiary on Upper Cretaceous fine-grained sandstones tested oil and gas at Mayogiak field. These fields and other structures mapped seismically on the peninsula have relatively small closures and as such, the reserves anticipated may be individually

small. The presence of numerous structures and their location on land where drilling costs are lower than offshore, however, will encourage further exploration after a pipeline is constructed to the fields of the Mackenzie Delta and the Beaufort Sea.

The mineral potential of the Ibyuk Hill area is considered very low because the area is underlain by thick alluvium.

There are no mineral claims over the area.

The Ibyuk Hill pingo area was under oil and gas exploration permit to Imperial Oil Limited. Following a number of meetings the company agreed in 1976 to surrender their interests in the Ibyuk Hill area.

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ALKEMA, Y.R. and KOVACS, T.J.
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